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the removal actions within the Boeing DSOA and the RAB are required to be integrated and sequenced to minimize the potential for recontamination of sediments adjacent to either facility during and prior to removal action. EPA has also committed to completing the EAA-5 cleanup concurrent with the Boeing DSOA and RAB cleanups during the 2013 in-water work window, although the current schedules shows the EAA-5 cleanup initiating following completion of the RAB cleanup. EPA will require the use of sufficient environmental controls during these cleanup actions to significantly minimize the potential for sediment transport and deposition to the RAB during the cleanup activities.

Alternatively, EAA-6, which is located immediately upstream of the RAB, and other sediment areas further upstream are not currently scheduled for cleanup prior to cleanup in the RAB. Ongoing releases and/or sediment transport and deposition to the RAB from these areas could contribute elevated chemical concentrations to the RAB following completion of the removal action. Long-term monitoring within the RAB will document the sediment quality impacts due to this ongoing off-site source loading.

## 2.3 Selected Removal Action Alternative

The EPA-approved removal action alternative (EPA 2011a) includes the vertical and horizontal removal of all total PCB RvAL sediment and shoreline bank exceedances identified within the RAB. In accordance with EPA's direction, the RAB was developed by screening all of the available sediment and shoreline bank soils total PCB data against the total PCB RvAL. Based on the findings of the data screening and the site-specific conditions described in the Final EE/CA (Anchor QEA 2011a), the EPA-approved RAB was identified as the approximately 1.6-acre area shown in Figure 4, and is bounded by the following:

- To the east by the top of shoreline bank (including the top of sheetpile and concrete panel walls) extending from the northern to southern Facility property boundaries, with two areas extending just beyond the top of bank, as discussed below
- To the south by the extension of the southern Facility property boundary from the top of the concrete panel wall to the eastern boundary of the federal navigation channel
- To the west by the eastern boundary of the federal navigation channel extending from the southern boundary to the Boeing DSOA in-water cleanup boundary

- Tug traffic occurs two to five times per week
- Yachts ranging from 100 to 160 feet in length travel to and from Delta Marine, located at RM 4.2 (upstream of the RAB)

### *3.2.8 Ecosystem Considerations*

This section provides a brief overview of the habitat likely to be affected near the RAB:

- Biota:
  - The dominant benthic macrofauna included nematodes, oligochaetes, the gammarid amphipod *Corophium spp.*, the cumacean *Leucon sp.*, the polychaetes *Manayunkia aesturina* and *Hobsonia florida*, and several species in the family *Spionidae*.
  - The bivalve *Macoma spp*.
  - The benthic meiofauna (smaller marine organisms) community is dominated by harpacticoid copepods and nematode worms (Cordell et al. 1994, 1996).
- Shellfish: includes clams (mostly *Macoma balthica*, and occasionally *Macoma spp.* and *Mya arenaria)*, crabs (slender crab [*Cancer gracilis*] and Dungeness crab [*Cancer magister*]), shrimp, and mussels.
- Salmonids: species include Chinook salmon *(Oncorhynchus tshawytscha),* coho salmon *(Oncorhynchus kisutch),* chum salmon (*Oncorhynchus keta),* pink salmon *(Oncorhynchus gorbuscha),* steelhead trout *(Oncorhynchus mykiss),* cutthroat trout *(Oncorhynchus clarkiclarki)*
  - Note: to protect listed salmonid species, timing for in-water construction work (for example, dredging, backfilling, and habit placement) in the LDW typically extends annually from October 1 to February 15 (the USACE work window). However, the NMFS and USFWS have allowed work to start August 1, 2013.
- Non-salmonid Fish: includes shiner surfperch *(Cymatogaster aggregata),* snake prickleback*(Lumpenus sagitta),* Pacific sandlance*(Polygonella myriophylla),* Pacific staghornsculpin*(Leptocottus armatus),* longfin smelt *(Spirinchus thaleichthys),* English sole (*Pleuronectes vetulus),* juvenile Pacific tomcod *(Microgadus proximus),* pile perch (*Damalichthys vacca),* rock sole (*Lepidopsetta bilineata),* surf smelt

# 8 SHORT-TERM IMPACTS DURING CONSTRUCTION

This section describes the temporary impacts that are anticipated due to the construction activities.

## 8.1 Construction Impacts to Adjacent Sediments

To minimize the potential for resuspension of contaminated sediments, BMPs, operational controls, engineering controls, and monitoring requirements have all been specified as part of the design as described in Section 4.1. Collectively, all these elements will greatly reduce any potential for contamination of sediments both upstream and downstream of the RAB.

In addition, pre- and post-remediation perimeter surface sediment samples will be collected to confirm that there are no material increases in concentrations of COCs in surface sediments adjacent to the RAB relative to their pre-remediation concentrations. Detailed sampling methods, sampling station coordinates, and quality control protocols are provided in the CQAP (Appendix D).

A summary of perimeter monitoring methods and objectives is provided in this section.

### *8.1.1 Monitoring Objectives, Methods, and Timing*

The objective of perimeter surface sediment monitoring adjacent to the RAB is to verify that COC concentrations in adjacent surface sediment (0 to 10 cm) have not significantly increased as a result of the removal action. The perimeter surface sediment monitoring is designed to compare pre-remediation and post-remediation COC concentrations in areas adjacent to the RAB that may have been impacted by the remedial action.

To better assess the potential contributions from removal action construction releases versus off-site sources, samples will be collected in an area directly adjacent to the RAB as well as an upstream area outside the influence of the construction, as shown on Figure 3 of the CQAP (Appendix D). A total of six discrete samples from each area will be chemically analyzed for PCBs, metals, and TOC.

Pre-construction grab samples will be collected at the locations shown in Figure 3 of the CQAP (Appendix D) prior to the start of any removal action activities. Post-construction grab samples will be collected from the locations shown in Figure 3 of the CQAP (Appendix D) as soon as possible after backfill to the final grade is complete.

Additional surface sediment monitoring of sediments adjacent to the RAB may be performed during active remediation, contingent upon removal activity by other LDW parties, concurrent with construction.

## 8.2 Construction Impacts to Structures or Outfalls

There are no adverse construction impacts anticipated to any outfalls located within or near the RAB.

Within the vicinity of the RAB, there are currently nine outfalls. All six of the outfalls located downstream of the sheetpile wall are inactive as well as outfalls 001 and 002 that historically discharge through the concrete panel and sheetpile walls, respectively. Outfall 003 discharges through the sheetpile wall and is still being used for ongoing Facility stormwater discharges. However, as discussed in Section 6.5, outfall 003 will be abandoned following the installation of a new outfall that will occur concurrently with the removal action construction activities. The newly constructed outfall will extend through the shoreline bank and discharge at approximately -9.5 foot MLLW elevation. The outfall discharge will be equipped with a diffuser arrangement that will be protected from scour and debris. The outfall construction will be sequenced and coordinated with the dredging and shoreline bank reconfiguration.

## 8.3 Water Quality Impacts

Short-term impacts to water quality may occur during subtidal or intertidal sediment-disturbing construction activities. These potential impacts would be primarily associated with increased turbidity caused by the resuspension or erosion of sediments or backfill material into the water column in active construction areas. Potential turbidity-generating construction activities for this project include dredging and backfilling in the subtidal

portions of the RAB, and excavating and slope containment placement in the intertidal portions of the RAB.

A WQMP (Appendix E) will be implemented to confirm that water quality standards are maintained during construction in accordance with EPA's 401 Water Quality Memorandum. Construction BMPs combined with a tiered program of instrumented and chemical water quality monitoring will be performed to monitor and control short-term water quality impacts from project construction activities and to address the substantive requirements of the Water Quality Memorandum.

A detailed description of recommended construction BMPs; water quality monitoring parameters, methods, locations, and schedules; a decision framework for contingency response; reporting requirements; and staff roles and responsibilities are provided in the WQMP (Appendix E). Key aspects of the WQMP are briefly summarized as follows.

### *8.3.1 Water Quality Criteria*

Based on beneficial use classification of the LDW as "excellent quality," the following Class A (excellent quality) marine water quality standards for field parameters will apply to this removal action except within the authorized mixing zone:

- Turbidity. Turbidity must not exceed 5 nephelometric turbidity units (NTU) over background when background turbidity is less than 50 NTU, or have more than a 10 percent increase over background when the background turbidity is greater than 50 NTU.
- Dissolved oxygen (DO). DO shall not drop below 6.0 milligrams per liter (mg/L) at the compliance boundary.

Compliance with turbidity criteria will evaluated at the compliance boundary (edge of the mixing zone), which is located 150 feet downcurrent (i.e., downstream during ebb tide and weak flood tides or upstream during strong flood tides) from the construction activity.

In addition, chemical monitoring of the site COCs will be performed during removal action construction activities. Compliance criteria for the COCs will be both the acute and chronic

water quality criteria based on the National Recommended Water Quality Criteria for metals and the Washington State Acute Marine Criterion for PCBs (WAC 173-201A-240). Compliance with these criteria will be evaluated at the edge of the 150- and 300-foot compliance boundaries, which are located 150 and 300 feet from the construction work area, respectively.

Finally, the following visual parameters will be monitored during construction:

- Oil Sheen. No oil sheen or product must be visible anywhere in the project area
- Distressed or dying fish. No distressed or dying fish must be visible anywhere in the project area

### *8.3.2 Monitoring Locations*

During each monitoring event, field parameters (i.e., turbidity, DO, and temperature) will be measured at the background station and the upriver or downriver early warning station and 150-foot compliance boundary stations (depending on tide direction), as shown on Figure 3 in the WQMP (Appendix E). Chemical monitoring, when required, will be performed at the background, 150- and 300-foot compliance stations (Figure 3). Chemistry samples will be collected from both the background and compliance stations (upriver and downriver) regardless of tidal direction. Samples collected at the background and downcurrent 150-foot and 300-foot compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent 150-foot and 300-foot compliance stations and all other depths will be archived for future potential analysis, pending results of the samples taken at the downcurrent depth with the highest turbidity (see Section 8.3.4).

The location of the background station will remain the same for all monitoring events. A description of all monitoring stations is provided below and shown on Figure 3 of the WQMP.

- **150-foot Compliance Stations (150C)**. The 150-foot compliance station is located at the edge of the inner mixing zone 150 feet up or downriver (depending on tide direction) from the construction work area. The 150-foot compliance station (Station 150C) is at approximately the same water depth as the construction activity.

Compliance with field parameter water quality criteria will be evaluated at the downcurrent 150C station. When required by the monitoring schedule, compliance with COC acute criteria will be evaluated at upcurrent and downcurrent 150C stations.

- **300-foot Compliance Station (300C).** The 300-foot compliance stations are located at the edge of the outer mixing zone 300 feet upriver and downriver from the construction work area. The 300-foot compliance stations (station 300C) are at approximately the same water depth as the construction activity. Compliance with chemical parameter chronic criteria will be evaluated at these stations.
- **Early Warning Station (EW)**. The early warning station (Station EW) is located 75 feet up or downriver (depending on tide direction) from the construction work area, at approximately the same water depth as the construction activity. The objective of the early warning station is to become more quickly aware of potential water quality impacts at the construction work area, and to be able to adjust dredging operations or BMPs before an exceedance occurs at the compliance station.
- **Background Station (BG)**. The background station (Station BG) is located 600 feet upriver from the RAB and beyond the influence of removal action construction activities. Coordinates of the background station are provided on Figure 3 of the WQMP. The background station will be monitored during every event because the turbidity criterion is based on an acceptably small increase in the vicinity of the RAB relative to ambient LDW background levels.

### *8.3.3 Monitoring Schedules*

Water quality monitoring schedules are divided into three tiers for all in-water work, as summarized in Table 2 of the WQMP (Appendix E). Tier I indicates monitoring that will be performed during the first four days of in-water removal work. Tier II reflects monitoring that will occur during all in-water removal work after the first four days of monitoring have been performed. Finally, Tier III reflects monitoring that will occur during in-water backfill placement. Additionally, chemical monitoring frequency will be increased during removal activities performed within a small area in the RAB showing relatively elevated total PCB concentrations (Figure 4 of the WQMP). The following subsections and Table 2 of the

WQMP provide a detailed summary of the monitoring schedules for the specific removal action activities.

#### *8.3.3.1 Tier I Schedule*

Tier I monitoring will occur for the first four days of in-water removal activity (i.e., dredging, in-water debris removal, pile removal or submerged shoreline bank excavation) and includes the measurement of field parameters (i.e., turbidity, DO, and temperature) twice daily at the background, downcurrent early warning and downcurrent 150-foot compliance stations, depending on tide direction. In addition, water samples will be collected for chemical analysis twice daily at the background, 150-foot compliance and 300-foot compliance stations once during the first four days of monitoring, concurrent with removal in areas showing the highest relative total PCB concentrations.

The first daily monitoring round should be conducted at least 1 hour after the startup of daily work activities. The second daily monitoring round should be separated by a minimum of four hours from the first monitoring round. If practicable, monitoring events should target one flood tide and one ebb tide condition. No monitoring will be performed within two hours before dark and during dark hours due to safety concerns.

As described in Section 8.3.2, during ebb and slack tides, the early warning and 150-foot compliance stations for field parameters will be oriented downriver. During flood tides, the early warning and 150-foot compliance stations for field parameters will be oriented upriver to account for the reversing tidal current, as shown on Figure 3 of the WQMP. When chemical monitoring is required, samples will be collected from both the upriver and downriver 150- and 300-foot compliance stations. Samples collected at the background and downcurrent compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent compliance stations and all other depths will be archived for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 8.3.4).

#### *8.3.3.2 Tier II Schedule*

After four consecutive days of Tier I monitoring, monitoring will be reduced to the Tier II schedule, which includes measurement of the field parameters (i.e., turbidity, DO, and temperature) twice daily, three days per week. In addition, water samples will be collected for chemical analysis twice daily, once per week. Field parameter and chemical monitoring will be scheduled each week to coincide with removal of the highest relative total PCB concentrations.

As described in Section 8.3.2, during ebb and slack tides, the early warning and 150-foot compliance stations for field parameters will be oriented downriver. During flood tides, the early warning and 150-foot compliance stations for field parameters will be oriented upriver to account for the reversing tidal current, as shown on Figure 3 of the WQMP. When chemical monitoring is required, samples will be collected from both the upriver and downriver150- and 300-foot compliance stations. Samples collected at the background and downcurrent compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent compliance stations and all other depths will be archived for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 8.3.4).

#### *8.3.3.3 Tier III Schedule*

Tier III monitoring will be performed during in-water backfill placement and includes the one-time measurement of field parameters (i.e., turbidity, DO, and temperature) two times in a single day at the background, early warning and 150-foot compliance stations. No chemical monitoring will be performed during backfill placement. No monitoring will be performed within two hours before dark and during dark hours due to safety concerns.

#### *8.3.3.4 Elevated Total PCB Concentration Area Schedule*

During in-water removal activity conducted within the relatively elevated total PCB concentration area shown on Figure 4 of the WQMP (Appendix E), chemical monitoring frequency will be increased to a minimum total of twice daily, two days per week. Chemical samples will be collected from the background and upstream and downstream 150C and

300C stations (Figure 3 of the WQMP). Downcurrent (depending on tide direction) and background samples collected from the depth with the highest turbidity identified with concurrent turbidity measurements will be submitted for analysis. Samples collected at all other depths and upcurrent compliance stations will be archived for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 8.3.4). Field parameters will be collected at the indicated Tier I or Tier II schedule.

### *8.3.4 Responding to Exceedances of Water Quality Criteria*

A detailed summary of the necessary response actions if water quality exceedances are identified is provided in the WQMP (Appendix E) and summarized in the subsections below.

#### *8.3.4.1 Exceedance of Conventional Parameters*

If conventional parameters (turbidity or DO) are exceeded at the 150-foot compliance boundary during removal action construction activities, the following contingency actions will be implemented:

1. Immediately notify Contractor and the Construction Quality Assurance Officer (CQAO).Immediately re-take field measurements at the Compliance Stations (and if necessary, the Background Station) to confirm, or not confirm, the exceedance.
2. If exceedance is confirmed, immediately notify the Contractor, CQAO, and EPA.
3. Evaluate the concurrent measurements at the Background Station and supporting visual evidence to determine whether the exceedance is caused by removal action construction activities versus other ambient conditions in the LDW (e.g., wind waves, boat wakes, barge/ship traffic, or storm inflow).
4. If the exceedance is confirmed and attributed to removal action construction activities:
    a. Immediately notify the Contractor and the CQAO.
    b. The Contractor will be directed to immediately modify operations or implement additional BMPs to mitigate the exceedance (see Section 4 for list of construction BMPs to protect water quality).
    c. Immediately collect additional chemical water samples at the upstream and downstream 150- and 300-foot compliance stations and background station.

i. Immediately analyze the background and downcurrent compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity. Archive all other samples for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 8.3.2.4).

5. Re-take field measurements at all stations 2 hours later, after additional BMPs or operational modifications are implemented.
6. Within 24 hours, notify EPA of the exceedance, actions taken to mitigate the exceedance, and the results of the follow-up measurements. If the water quality exceedance continues to persist, even with additional BMPs or operational modifications, a path forward will be discussed with EPA. The path forward could include some or all of the following:
    a. Implement more aggressive BMPs or operational modifications.
    b. Implement more intensive monitoring to better track the growth or dissipation of the plume.
    c. If options (a) or (b) are not successful at controlling the water quality exceedance, it may be necessary to stop work to further assess the source of the exceedance, identify effective mitigation measures, and allow the water column to recover.

### *8.3.4.2 Exceedance of Chemical Criteria*

If acute criteria are exceeded at the downcurrent 150-foot compliance boundary at the depth with the highest turbidity, or chronic criteria are exceeded at the downcurrent 300-foot compliance boundary at the depth with the highest turbidity, the following actions will be implemented:

1. Immediately notify the Contractor, CQAO, and EPA.
2. In consultation with EPA, evaluate the concurrent measurements at the Background Station and supporting evidence to determine whether the exceedance is caused by removal action construction activities versus other ambient conditions in the LDW (e.g., visual observations, wind waves, boat wakes, barge/ship traffic, other construction activity within the LDW, or storm inflow).

3. If exceedance is attributed to removal action construction activities:
    a. Assess construction methods and existing BMPs.
    b. Analyze concurrent archived samples collected at the compliance boundary (both upstream and downstream) where exceedance was observed to determine if 1-hour average concentrations exceed the compliance criteria.
    c. If 1-hour average concentrations at the 300-foot compliance boundary exceed the chronic criteria, analyze remaining archived samples collected at the 300-foot compliance station on the day of the exceedance to determine if 24-hour concentrations exceed the compliance criteria.
4. If average concentrations exceed the compliance criteria, discuss path forward with EPA. The path forward could include some or all of the following:
    a. Implement more aggressive BMPs or operational modifications.
    b. Implement more intensive monitoring to better track the growth or dissipation of the plume.
    c. If options (a) or (b) are not successful at controlling the water quality exceedance, it may be necessary to temporarily stop work to further assess the source of the exceedance and identify effective mitigation measures. Additionally, samples may be collected at 200 and 250 feet from construction activity to support a potential modification to the 150-foot mixing zone.

### *8.3.5 Reporting*

Daily, weekly, and final reporting of water quality monitoring results is required for this project as described in the WQMP (Appendix E).

- **Daily Reporting.** Daily field documentation will be scanned and e-mailed to the CQAO at the end of each field day. Unless an exceedance of a water quality parameter occurs (which would trigger contingency response actions), daily field results will not be transmitted to EPA unless specifically requested.
- **Weekly Reporting.** The results from each week's water quality monitoring activities will be compiled into a summary table with a comparison to water quality compliance criteria and provided to EPA as part of the Weekly Progress Report.

- **Final Water Quality Monitoring Results**. After all construction has been completed, the water quality monitoring data for the entire construction project will be provided to EPA in the *Draft Removal Action Completion Report*. This data summary will include a discussion of any water quality exceedances (if any), probable cause of the exceedance(s), results of follow-up measurements, agency communications and decisions, actions taken to mitigate the exceedance(s), and lessons learned for future projects.

**Table 5**

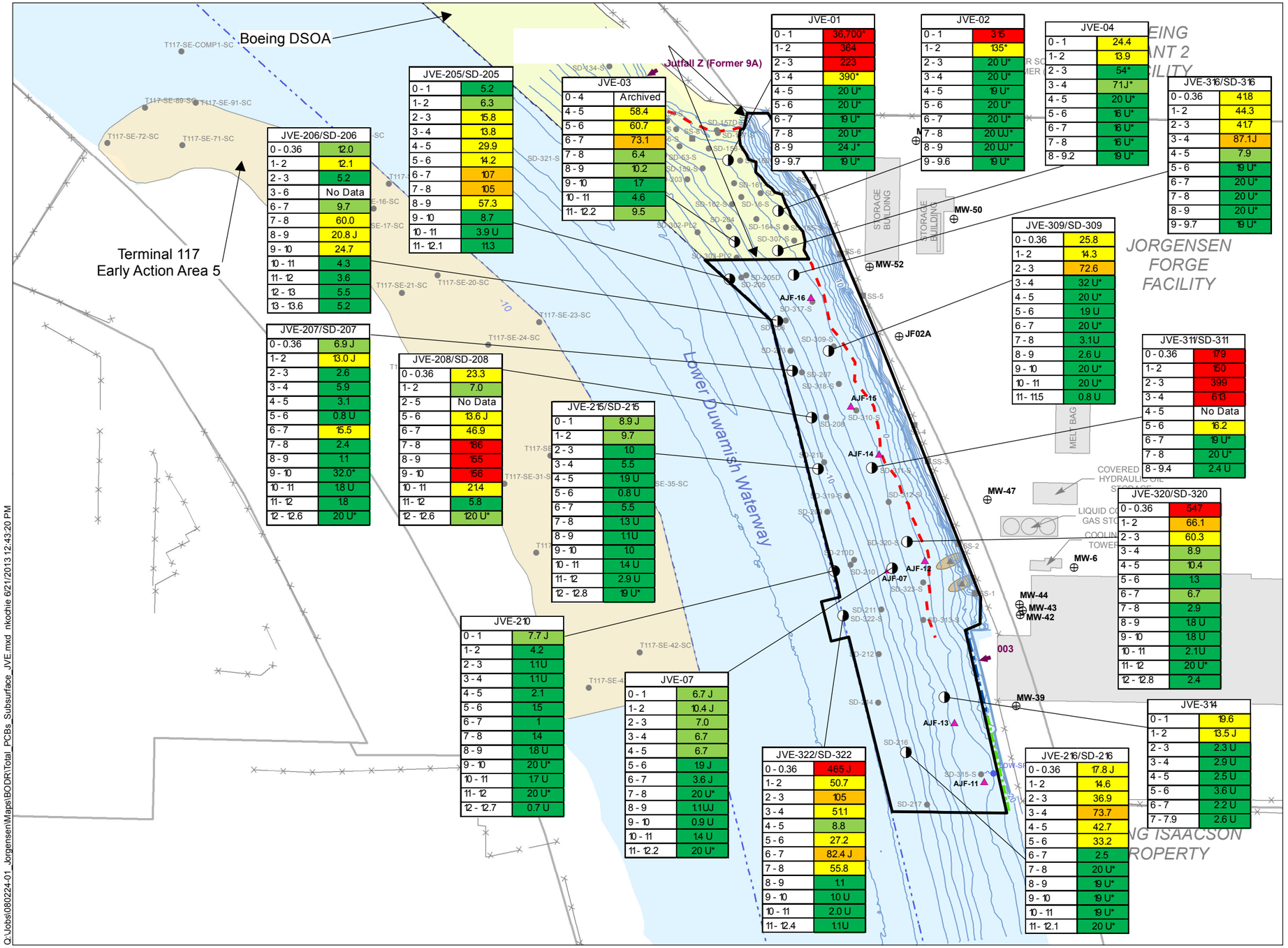
**Backfill Chemical Acceptance Criteria[1]**

| Parameter | Backfill Levels (mg/kg) |
|---|---|
| **Metals** | |
| Arsenic | 13.6 |
| Cadmium | <5.1 |
| Chromium[2] | 67.6 |
| Copper | 49.9 |
| Lead | 250 |
| Mercury | <0.41 |
| Silver | <6.1 |
| Zinc | <410 |
| **Organics** | |
| PCBs[3] | < PQL of 0.03 |
| SMS Organics[3] | < SMS SQS/LAET (expressed as dry weight) |

Notes:

1. The EPA-approved backfill concentration levels are defined in the EPA letter RE: *Action Memorandum, Responsiveness Summary and Future Actions*, Jorgensen Forge Early Action Area, 8431 East Marginal Way South, Seattle, Washington, Comprehensive Environmental Response, Compensation and Liability Action (CERCLA) Administrative Order on Consent (EPA Docket No. CERCLA-10-2003-001) dated October 7, 2011.
2. See text in Action Memorandum for type of chromium used for this backfill level.
3. The PCBs and SMS SQS are listed as including the dry weight equivalents of the standards because the fill material is expected to contain very little organic carbon, making it inappropriate to carbon normalize the organic concentrations.

EPA = U.S. Environmental Protection Agency
LAET = Lowest Apparent Effects Threshold
mg/kg: milligram per kilogram
PCB = Polychlorinated biphenyl
PQL = Practical Quantitation Limit
SMS = Sediment Management Standard
SQS = Sediment Quality Standard




Total PCBs[1]

- Less than 0.5x SQS/ LAET
- Between 0.5x SQS/ LAET to SQS/ LAET
- Between SQS/ LAET to CSL/ LAET
- Between CSL/ LAET to 2x CSL/ LAET
- Greater than 2x CSL/ LAET
- Non-detected Concentrations greater than SQS

JVE-04

| | |
|---|---|
| 0 - 1 | 24.4 |
| 1 - 2 | 13.9 |
| 2 - 3 | 54* |
| 3 - 4 | 71* |

- Subsurface Core Station ID
- PCB Concentration (mg/kg-OC)
- * PCB Concentration (µg/kg) for TOC value was greater than 0.5% or less than 3%
- Depth Interval in feet

**LEGEND**

- Vertical Extent Sampling Location (Anchor, 2011)
- Subsurface Samples (Anchor, 2005)
- Subsurface Sampling Locations (others)
- Shoreline (0-2 ft) Bank Samples (Farallon, 2004)
- Debris Pile Samples (Farallon, 2004)
- Seep Sampling Location (Windward, 2004b)
- Groundwater Monitoring Well
- Active Outfall
- Existing Concrete Panel Wall
- Toe of Existing Riprap
- Existing Sheetpile Wall
- Fences
- Federal Channel
- Removal Action Boundary
- Debris Pile
- Property Boundaries
- Boeing DSOA
- Terminal 117 Early Action Area 5 Boundary

NOTES:

1. Sediment samples were OC-normalized and compared to SQS and CSL Total PCBs criteria. Sediment samples with TOC <0.5% or TOC >3% were not OC-normalized and were compared to LAET and 2LAET Total PCBs criteria. *TOC value was <0.5% or > 3%; reported in µg/kg dry weight.

2. Bathymetric survey by eTrac dated February 8, 2012. Additional back survey by AEC Consultants, Inc. dated February 21, 2012. Bathymetric and bank survey merged with upland survey by PLS, Inc. dated January 24, 2012.

3. Outfall locations field identified on May 14, 2003.

4. The toe of existing riprap slope was surveyed during a low tide on August 28, 2008.

5. The Boeing-EMJ/Jorgensen cleanup boundaries are identified in the Memorandum of Understanding between Boeing and EMJ/Jorgensen Forge, dated August 2007 (EMJ et al. 2007).

6. Sediment Quality Standard (SQS) = 12 mg/kg-OC.

7. Lower Apparent Effects Threshold (LAET) = 0.13 mg/kg.

8. Cleanup Screening Level (CSL) = 65 mg/kg-OC.

9. Second Lower Apparent Effects Threshold (2LAET) = 1 mg/kg.

10. U = Compound analyzed, but not detected above detection limit.

11. J = Estimated value.

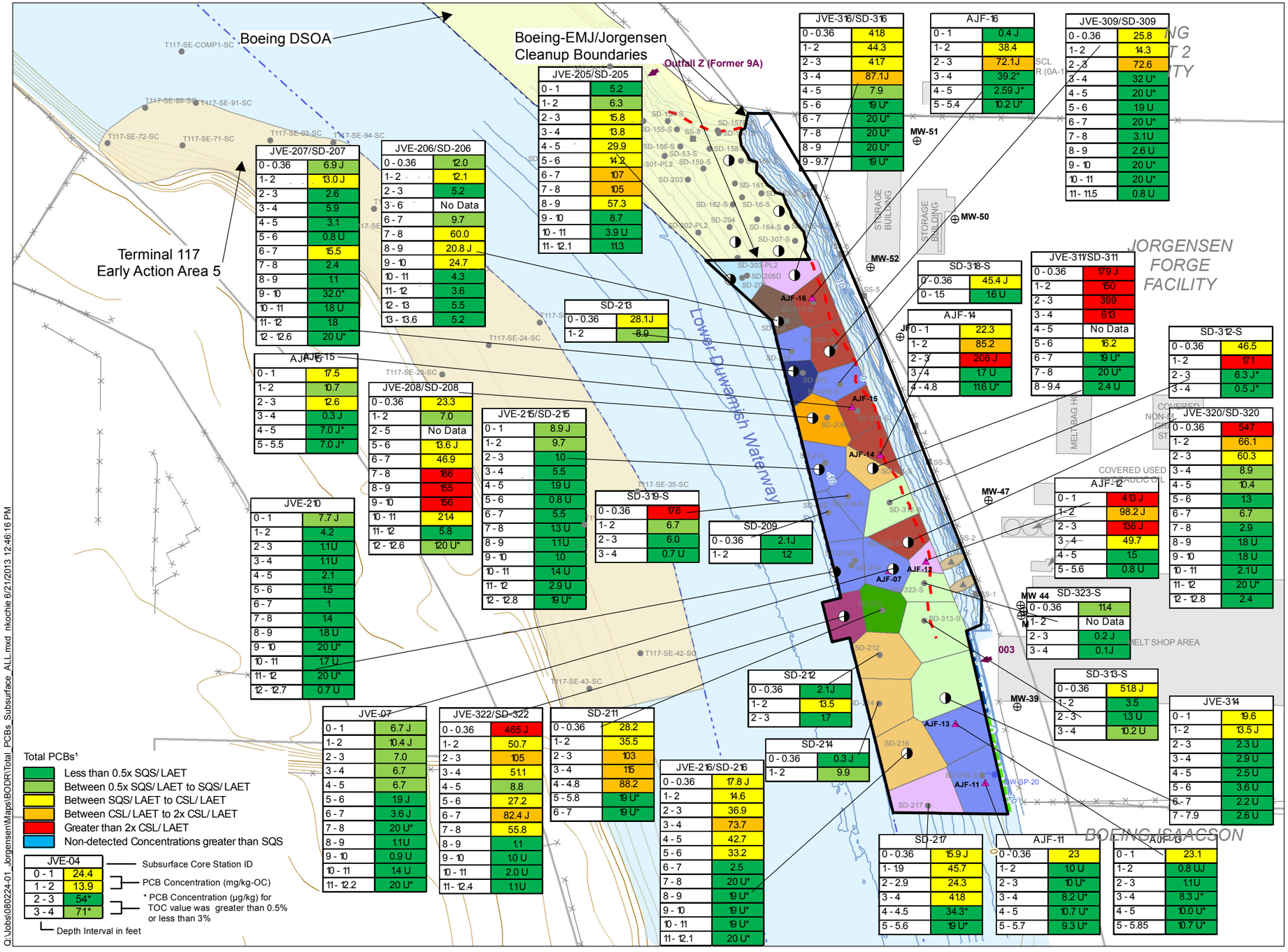
12. UJ = Compound analyzed, but not detected above estimated detection limit.

Q:\Jobs\080224-01_JorgensenMags\BODR\Total_PCBs_Subsurface_JVE.mxd mkochie 6/21/2013 12:43:20 PM

ANCHOR QEA

Feet
0 50 100 150 200

**Figure 6**
Subsurface Total PCB Concentrations at Additional Design Sampling Locations
Basis of Design Report
Jorgensen Forge Early Action Area




**LEGEND**

- Vertical Extent Sampling Location (Anchor, 2011)
- Subsurface Samples (Anchor, 2005)
- Subsurface Sampling Locations (others)
- Shoreline (0-2 ft) Bank Samples (Farallon, 2004)
- Debris Pile Samples (Farallon, 2004)
- Seep Sampling Location (Windward, 2004b)
- Groundwater Monitoring Well
- Active Outfall
- Concrete Panel Wall
- Toe of Riprap
- Sheetpile Wall
- Fences
- Federal Channel
- Removal Action Boundary
- Debris Pile
- Property Boundaries
- Boeing DSOA
- Terminal 117 Early Action Area 5 Boundary

**Thiessen Polygon Depth of Contamination²**

- 1 ft below mudline
- 2 ft below mudline
- 3 ft below mudline
- 4 ft below mudline
- 5 ft below mudline
- 6 ft below mudline
- 7 ft below mudline
- 8 ft below mudline
- 9 ft below mudline
- 10 ft below mudline
- 11 ft below mudline

NOTES:

1. Sediment samples were OC-normalized and compared to SQS and CSL Total PCBs criteria. Sediment samples with TOC <0.5% or TOC >3% were not OC-normalized and were compared to LAET and 2LAET Total PCBs criteria.
*TOC value was <0.5% or > 3%; reported in µg/kg dry weight.

2. The depth of contamination was determined based on exceedances of the Total PCB Removal Action Level (RvAL), which EPA identified as the SQS concentration.

3. Bathymetric survey by eTrac dated February 8, 2012. Additional back survey by AEC Consultants, Inc. dated February 21, 2012. Bathymetric and bank survey merged with upland survey by PLS, Inc. dated January 24, 2012.

4. Outfall locations field identified on May 14, 2003.

5. The toe of riprap slope was surveyed during a low tide on August 28, 2008.

6. The Boeing-EMJ/Jorgensen cleanup boundaries are identified in the Memorandum of Understanding between Boeing and EMJ/Jorgensen Forge, dated August 2007 (EMJ et al. 2007).

7. Sediment Quality Standard (SQS) = 12 mg/kg-OC.

8. Lower Apparent Effects Threshold (LAET) = 0.13 mg/kg.

9. Cleanup Screening Level (CSL) = 65 mg/kg-OC.

10. Second Lower Apparent Effects Threshold (2LAET) = 1 mg/kg.

11. U = Compound analyzed, but not detected above detection limit.

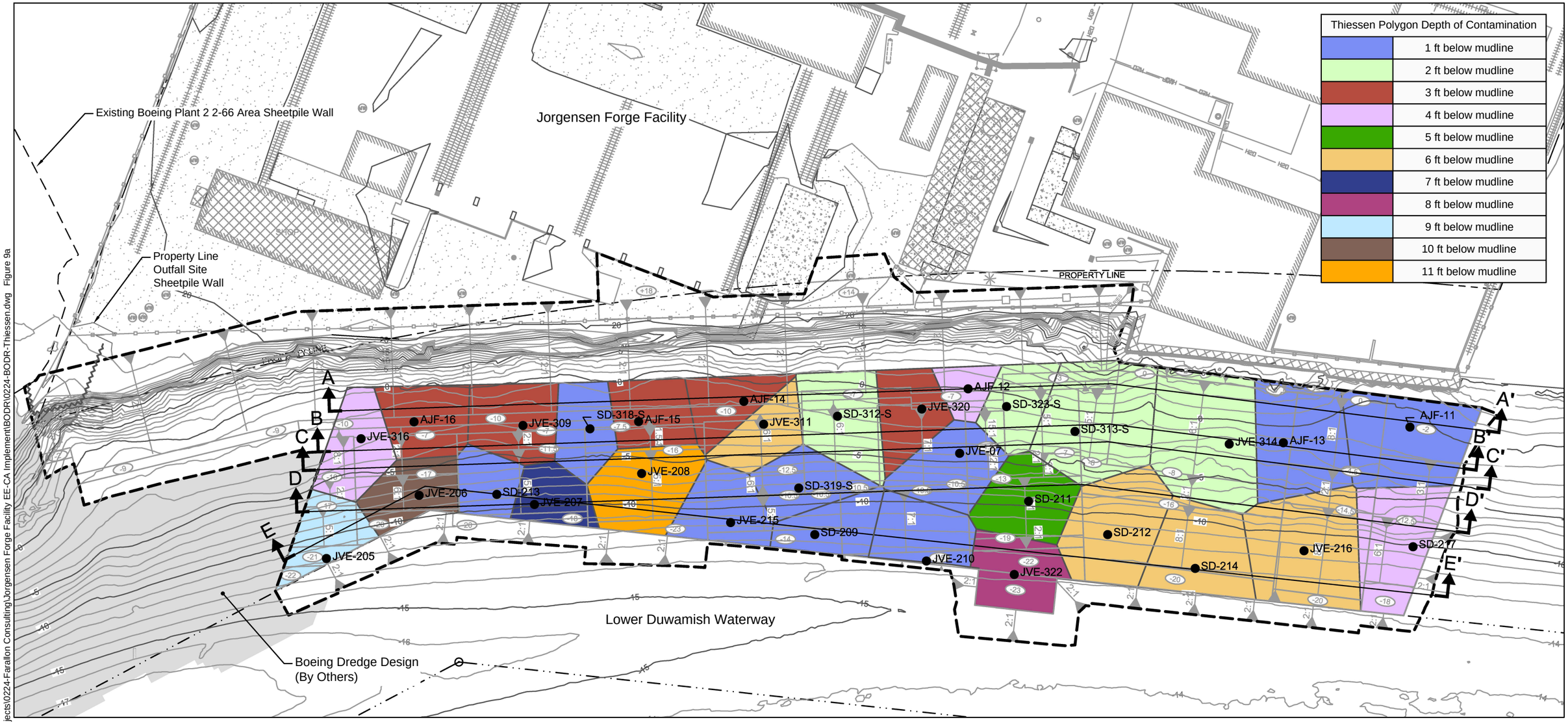
12. J = Estimated value.

13. UJ = Compound analyzed, but not detected above estimated detection limit.

ANCHOR QEA

Feet
0 50 100 150 200

**Figure 7**
Subsurface Total PCB Concentrations & Depth of Contamination
Basis of Design Report
Jorgensen Forge Early Action Area




**HORIZONTAL DATUM:** Washington State Plane North, NAD83.
**VERTICAL DATUM:** Mean Lower Low Water (MLLW).
**NOTE:** Existing Topography created from a merge of survey data by Anchor QEA including upland survey by PLS Inc. (1/24/12), bathymetric survey by eTrac (2/8/12), bank survey by AEC Consultants Inc (2/21/12), and additional bank survey by Duane Hartman & Associates, Inc. (10/25/20).

* Depth of contamination based on PCB exceedances of the removal action level (12 mg/kg-OC)

**LEGEND:**

- Navigation Channel
- Existing Bathymetry (1 ft interval)
- Existing Fence Line
- Required Dredge Elevation (ft MLLW)
- Top of Side Slope
- Final Grade
- Dredge Boundary
- Dredge/Excavation Limits
- Slope Arrow
- Structures to Preserve and Protect Adjacent to Dredge/Excavation Limits
- JVE-322 Subsurface Sampling Location

0 50
Scale in Feet

K:\Projects\0224-Farallon Consulting\Jorgensen Forge Facility EE-CA Implement\BODR\0224-BODR-Thiessen.dwg Figure 9a
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**Figure 9a**
Thiessen Polygon Minimum Removal Depths
Basis of Design Report
Jorgensen Forge Early Action Area